



Federal Reserve Bank of Chicago

## **AIG in Hindsight**

*Robert McDonald and Anna Paulson*

October 2014

WP 2014-07

# AIG in Hindsight<sup>1</sup>

October 22, 2014

Robert McDonald

Kellogg School of Management, Northwestern University and NBER

Anna Paulson

Federal Reserve Bank of Chicago

## Abstract

The near-failure on September 16, 2008, of American International Group (AIG) was an iconic moment in the financial crisis. The decision to rescue AIG was controversial at the time and remains so. Large bets on real estate pushed AIG to the brink of bankruptcy. In one case, AIG used securities lending to transform insurance company assets into residential mortgage-backed securities (RMBS) and collateralized debt obligations (CDOs), ultimately losing at least \$21 billion and threatening the solvency of the life insurance companies. AIG also sold insurance on multi-sector CDOs, backed by real estate assets, ultimately losing more than \$30 billion. These activities were apparently motivated by a belief that AIG's real estate bets would not suffer defaults and were "money-good." We find that these securities have in fact suffered write-downs and that the stark "money-good" claim can be rejected.

---

<sup>1</sup>Ben Chabot, Mark Finn, Arvind Krishnamurthy, Anil Kashyap, Andreas Lehnert, Debbie Lucas, David Marshall, Richard Miller, Richard Rosen, David Scharfstein, and Robert Steigerwald provided helpful commentary and feedback, as did seminar participants at Case Western and the Federal Reserve Banks of New York and Chicago. We are grateful to Kyal Berends, Mike Mei, and Thanases Plestis for excellent research assistance. The views presented here are solely our own and do not reflect those of the Federal Reserve Bank of Chicago or the Board of Governors of the Federal Reserve System. All errors are those of the authors.

The near-failure on September 16, 2008 of American International Group (AIG) was an iconic moment of the financial crisis. AIG, a global insurance and financial company with \$1 trillion in assets, lost \$99.3 billion during 2008 (AIG 2008b, p. 194) and was rescued with the help of the Federal Reserve Bank of New York, the Federal Reserve, and the Treasury. The rescue played out over seven months and involved the extension of loans, the creation of special purpose vehicles (SPVs), and equity investments by the Treasury. AIG's fate also provided an important touchstone in discussions of financial reform. AIG motivated the enactment of new rules for derivatives, the creation of an orderly liquidation authority, as well as rules governing non-bank institutions, allowing them to be designated as "systemically important," and subject to Federal Reserve oversight.

The decision to rescue AIG was controversial at the time and remains so. Most of the attention paid to AIG—and our focus—concerns two activities. First, AIG Financial Products (AIGFP) wrote credit default swaps (CDS) on over \$500 billion of assets, including \$78 billion on multi-sector collateralized debt obligations (CDOs) (AIG 2007b, p. 122). These swaps were held by other financial institutions. Second, AIG used loans of insurance subsidiary assets to finance the outright purchase of RMBS and real-estate-related CDOs. On September 16, 2008, the cumulative losses from these two activities were on the order of \$50 billion, and both appear to have played important roles in AIG's near-failure.

A central purpose of this paper is to examine in detail AIG's CDS and securities lending activities. These are the primary means by which AIG took on real estate exposure, and details of this risk-taking are available because of the rescue. We use available data,

taking reported prices as given, to create snapshots of AIG, other financial firms, and the performance of the assets underlying AIG's bets.

An issue central to any discussion of AIG is the question of whether the firm's difficulties stemmed from illiquidity or insolvency. The term "illiquidity" is imprecise, but at a minimum means that assets cannot be quickly sold at fair value and is often meant to refer to a price decline that is temporary. "Insolvency" usually means that the fair value of a firm's assets is less than the par value of liabilities. Illiquidity and insolvency are linked: A firm that can sell assets only at a steep discount to fair value may be insolvent as a consequence. We make no attempt to assess AIG's overall solvency, but we do consider whether AIG's real estate positions incurred permanent losses.

The insolvency vs. illiquidity debate is prominent with AIG, because AIG's real estate positions were apparently motivated by the belief that these investments would not default. The head of AIGFP, Joseph Cassano, often referred to the CDOs insured by AIGFP as "money good."<sup>2</sup> This implicitly attributes any price decline to illiquidity. Mark Hutchings, who ran AIG's securities lending business, made similar statements about the RMBS and CDO investments financed by securities lending.<sup>3</sup> To the extent that these assets subsequently suffered write-downs resulting in real losses (insolvency) rather than temporary price declines (illiquidity), the money-good claim proved to be false.

---

<sup>2</sup>For example, Cassano made these remarks in a December 5, 2007 investor presentation: <http://www.fcic.gov/documents/view/1139>. AIG structured the insurance it provided on CDOs such that "the risk of loss is considered to be insignificant". The insurance was structured so that AIG would face no modeled losses with 99.85% confidence under a scenario whose mean was set at the worst post World War II recession (Price Waterhouse Coopers, 2007).

<sup>3</sup>Hutchings makes these remarks in an interview with the Financial Crisis Inquiry Commission (FCIC): [http://fcic-static.law.stanford.edu/cdn\\_media/fcic-audio/2010-06-22%20FCIC%20staff%20audiotape%20of%20interview%20with%20Mark%20Hutchings,%20American%20International%20Group,%20Inc.mp3](http://fcic-static.law.stanford.edu/cdn_media/fcic-audio/2010-06-22%20FCIC%20staff%20audiotape%20of%20interview%20with%20Mark%20Hutchings,%20American%20International%20Group,%20Inc.mp3)

In Section 1, we summarize AIG's performance and characteristics from 2006 to 2008. We compare AIG's real estate holdings to the holdings of other financial firms and find that AIG's positions are roughly comparable to those of Citigroup and Bank of America, two other firms that received extensive support during the crisis.

In Section 2, we examine AIG's securities lending operations. By the end of 2007, AIG had loaned \$75 billion in securities, with 65% of lending proceeds invested in mortgage-backed securities. The securities lending business was characterized by a large liquidity and maturity mismatch, making it vulnerable to borrowers redeeming en masse. Ultimately, the company's total losses from securities lending amounted to at least \$21 billion; and we show that, without rescue funds, these losses threatened the solvency of some of AIG's life insurance subsidiaries. With standard bankruptcy resolution, securities lending counterparties are protected by collateral in the form of the borrowed securities, and the RMBS losses would have been borne by the insurance subsidiaries. Because of cross-state variation in laws governing the resolution of life insurance companies, the effects of an AIG bankruptcy that led to insurance insolvencies could have been uncertain for securities lending counterparties.

In Section 3, we examine AIG's credit default swap operations. By September 16, 2008 AIG's multi-sector CDS portfolio had lost more than \$33.9 billion. However, AIGFP had posted \$22.4 billion in collateral, leaving counterparties with exposure to AIG of \$11.5 billion. The maximum exposure of the largest individual AIGFP counterparties (accounting for 90% of the exposure) was less than 10% of their equity capital as of June 30, 2008.<sup>4</sup> We

---

<sup>4</sup>We obtained similar results using financial information from September 30, 2008.

discuss whether 10% of equity is large or small from various perspectives. AIG's other CDS positions do not appear to have played a significant role in its near-failure.

In Section 4, we describe the special purpose vehicles that the New York Fed created to deal with the assets related to AIG's securities lending and CDS operations. In order to assess the money-good claim, we examine write-downs on the assets in these portfolios from inception to September 2014. The money-good claim is equivalent to asserting that price declines during the crisis were temporary and due to illiquidity, but many of the securities we examine have suffered real losses. In interpreting this finding, it is important to keep in mind that prices reflect expectations over all possible future outcomes, and history reveals only one outcome. Policy interventions are part of that history, and price changes can be due to changes in liquidity or in real outcomes, or both. Even with hindsight, it is generally impossible to attribute price changes to one effect or the other. Although we cannot explain prices or price changes, we can assess the claim that assets were money good. We show that they were not: Both the insured CDOs and the RMBS investments financed by securities lending suffered principal write-downs. To date, the assets in aggregate have experienced principal write-downs of almost 4%, with most of the write-downs occurring after assets were sold by the Federal Reserve Bank of New York. As we discuss, this is almost certainly an underestimate of the ultimate write-downs.

In Section 5, we present our conclusions.

It is important to be clear about what we do not do in this paper: We do not address the broad question of what might have happened to the financial system had AIG failed, nor do we analyze the form of the rescue and whether it was profitable or justified. Similarly,

we do not analyze AIG's regulatory oversight prior to the crisis. Policymakers and academics have written extensively about potential systemic consequences from the failure of a large, interconnected financial firm like AIG.<sup>5</sup> See, for example, Acharya, Gale, and Yorulmazer (2011), Brunnermeier and Pedersen (2009), Kacperczyk and Schnabl (2010), Duarte and Eisenbach (2013), and Ellul, Jotikasthira, Lundblad and Wang (2014), among many others. We discuss the issues raised in these papers and others to the extent that they are important for understanding the implications of AIG's securities lending and CDS for multi-sector CDOs.

Our reexamination of AIG is with the benefit of hindsight. Multiple parties have studied the crisis in general and AIG in particular (for example, the Congressional Oversight Panel, the Financial Crisis Inquiry Commission (FCIC), and the Government Accountability Office). In addition, the Federal Reserve Bank of New York has made public data on the assets in the SPVs that it managed.

## **1. AIG before September 16, 2008**

AIG was an international insurance conglomerate with four main lines of business:

- General Insurance: property/casualty and commercial/industrial insurance;
- Life Insurance and Retirement: individual and group life insurance and annuities;
- Asset Management: private banking, brokerage, and investment advisory services;

---

<sup>5</sup>In testimony about the rescue, Federal Reserve Chairman Ben Bernanke noted that AIG had \$20 billion of commercial paper outstanding and \$50 billion of exposure to other banks via loans, lines of credit and derivatives.

- Financial Services: Capital markets division (including AIGFP), consumer finance, and aircraft leasing.

As with other large financial firms, AIG's fate during the financial crisis was determined largely by the extent of its exposure to real estate, including subprime mortgages. We construct an "adjusted balance sheet" in order to compare AIG's real estate exposure with that of other firms.

## Real Estate Exposure

We make two adjustments before we compare AIG's real estate exposure with that of other financial firms. First, AIG had a large written CDS portfolio which, although disclosed in footnotes, does not directly show up on the balance sheet. Second, a number of large banks had off-balance-sheet exposure to real estate through asset-backed commercial paper conduits (ABCP), which also do not show up on the balance sheet (Acharya, Schnabl, and Suarez, 2013). Both CDS and ABCP are equivalent to levered asset purchases, so it is possible to correct for both items by constructing adjusted balance sheets using this equivalence.

In its 2007 10K report, AIG listed \$1.06 trillion in assets (AIG, 2007b, p. 130). We incorporate CDS by recognizing that at issuance, a credit default swap is economically equivalent to a purchase of an insured asset financed by issuing floating rate debt (Duffie, 1999). If a firm with \$100 in assets and \$90 of debt writes a CDS on \$50 of CDOs, the economic result is as if the firm had \$150 in assets, \$50 of which are CDOs, financed with \$140 in debt. Note that the issuance of CDS implicitly changes assets and debt but not equity. Scaled appropriately, this is approximately AIG's situation: Accounting for written CDS in this fashion increases its balance sheet by 50%.

Similarly, if a bank has an ABCP conduit in which \$100 of mortgage securities are financed with \$100 of commercial paper, this is economically equivalent to the bank having an additional \$100 of both assets and debt. These adjustments are crude along at least two dimensions: They do not account for asset quality and they implicitly assume that the firms, except AIG, have net CDS positions of zero. Detailed data on CDS writing activities for the other firms are not available.

Table 1 compares AIG's adjusted real estate exposure with that of another large insurance company, Metlife, and with Citigroup, Bank of America, and JPMorgan Chase. Accounting for CDS as part of the adjusted balance sheet increases AIG's assets by 50% and similarly raises its leverage ratio from 11 to 17. Among these firms, AIG appears comparable to Bank of America and Citigroup, with high leverage and a high ratio of real estate exposure to assets and real estate to equity. AIG's effective real estate holdings were almost four times its book equity.

## Consequences of Real Estate Exposure

Unsurprisingly, AIG's large real estate exposure led to large losses during the financial crisis. Table 2 presents financial indicators for 2006–09, which help to put AIG's 2008 performance into perspective. AIG collapsed in 2008, losing money in all of its main lines of business, with the largest losses in the Life Insurance and Financial Services divisions. In both cases, the losses stemmed from heavy bets on real-estate-related financial products. In the case of financial services, AIGFP had written CDS on mortgage-related bonds, losing \$28.6 billion in 2008 (AIG, 2008b, p. 265). The life insurance division lost money primarily because of securities lending (\$21 billion in losses), where life

insurance company assets were loaned in exchange for cash that was used to invest in mortgage-related securities. Both of these activities relied on fragile funding that dried up when the values of real-estate-backed securities plummeted in 2007 and 2008. We discuss securities lending and CDS on mortgage-related bonds and the fragility of their funding in detail below.

It is important to note that AIG had been losing money well before the government rescue. AIG reported a \$13 billion loss for the first two quarters of 2008 (AIG, 2008a, p. 3) and AIG's stock price fell by more than 50% between January 1 and July 1 of that year. Not surprisingly, the losses led to credit rating downgrades. AIG's credit rating history is summarized in Table 3. AIG was first downgraded from AAA to AA in 2005, when longtime CEO Maurice Greenberg resigned and earnings were restated. The next downgrades occurred on September 15, 2008, at the peak of the financial crisis.

## **2. AIG's Securities Lending Business**

During 2008, AIG's life insurance subsidiaries lost approximately \$21 billion from securities lending, in which the life insurance subsidiaries loaned out assets and invested the proceeds in risky assets, including subprime RMBS and real-estate-backed CDOs. In this section, we discuss AIG's securities lending activity and its relationship to AIG's life insurance business. While much of the discussion concerning AIG has centered on its CDS business, which we discuss in the next section, securities lending losses were of a similar magnitude and created unique problems because of their links to the state-regulated life insurance subsidiaries. Recently, Pierce (2014) has examined the securities lending

business in detail. We argue that it is impossible to evaluate the potential consequences of an AIG failure without understanding AIG's life insurance and securities lending activities.

## What Is Securities Lending?

In a securities lending transaction, one party borrows a security from another and deposits collateral (typically cash) with the securities lender. The borrower may use the security as part of a short-selling strategy or to deliver a particular security to a customer. The securities lender invests the cash collateral and benefits from the yield that it earns on these investments minus a rebate that it pays to the borrower. The term of the transaction may extend for a number of months, but either party can typically terminate the transaction with notice of one day. The borrower can end the transaction by returning the security to the lender. The lender must also return the cash deposit to the borrower. A problem can arise if many borrowers simultaneously decide to end transactions and the securities lender does not have, or cannot raise, sufficient cash to meet the withdrawal requests in a timely fashion.<sup>6</sup>

## Characteristics of AIG's Securities Lending

AIG's securities lending activities were conducted "primarily for the benefit of certain AIG insurance companies" (AIG, 2007b, p. 108). These activities were centralized in a non-insurance subsidiary, AIG Global Securities Lending (GSL), which served as agent for AIG's life insurance companies. The life insurance companies provided securities, primarily corporate bonds, to GSL. These securities were lent to banks and broker dealers in return

---

<sup>6</sup> Securities lending transactions are very similar to repurchase agreements. See Adrian, Begalle, Copeland, and Martin (2013), for example. For additional background on securities lending, see Aggarwal, Saffi, and Sturgess (2012) and Bank of England (2010).

for cash collateral that was invested in order to earn a spread. These investment proceeds were used to fund a rebate fee to the security borrower, and the remainder was split 50-50 between GSL and the insurance companies.

At the peak in 2007Q3, AIG had securities lending payables of \$88.4 billion (AIG 2007a, p. 2) (see Figure 1). AIG consistently lent more than 15% of its domestic life insurance assets with some life insurance companies lending considerably more (see Table 4). By comparison, Metlife, another active insurance securities lender, never had more than 10% of its domestic life insurance assets on loan.<sup>7</sup>

Typically, securities lending collateral is invested in short-term, highly liquid securities since the agreements are callable on demand. Contrary to standard practice, however, AIG invested a substantial portion of the cash collateral it received from securities borrowers in longer term, illiquid instruments, including subprime RMBS. At the end of 2007, 65% of AIG's securities lending collateral was invested in mortgage-backed securities, asset-backed securities, and CDOs; 19% was in corporate bonds; and 16% was in cash or other short-term investments (AIG 2007b, p. 108).

In the weeks before AIG was rescued, securities lending counterparties began to terminate the lending agreements. AIG announced large second-quarter losses on August 6, 2008; the announcement of these losses and the possibility that they might lead to ratings downgrades appears to have accelerated its counterparties' actions to reduce their securities lending exposure to AIG. Because of market value losses on the invested

---

<sup>7</sup>Information from other financial institutions securities lending programs in 2007 and 2008 suggests that they invested securities lending collateral more conservatively than AIG. A 2007 survey of securities lenders shows 33% of lending proceeds invested in mortgage-backed securities, asset-backed securities, and CDOs; 42% in corporate bonds; and 25% in cash and short-term investments on average (Risk Management Association Survey, 2007).

collateral, AIG did not have sufficient funds to meet redemption requests. Losses on securities lending threatened the regulatory capital positions of AIG's life insurance subsidiaries, a point we discuss later and one that is also emphasized by Peirce (2014). Like many episodes during the crisis, AIG's securities lending problems can be viewed through the lenses of both solvency and liquidity. AIG summed up its dilemma with respect to securities lending with considerable understatement in its 2008 10K report: "During September 2008, borrowers began in increasing numbers to request a return of their cash collateral. Because of the illiquidity in the market for RMBS, AIG was unable to sell RMBS at acceptable prices and was forced to find alternative sources of cash to meet these requests" (AIG, 2008b, p. 40). On Monday, September 15, 2008, alone, AIG experienced returns under its securities lending programs that led to cash payments of \$5.2 billion (AIG, 2008b, p. 4).

On September 16, 2008, AIG received "alternative sources of cash," initially in the form of loans from the Federal Reserve Bank of New York and eventually from Maiden Lane II, which purchased AIG's remaining portfolio of RMBS and other securities in which it had invested securities lending collateral. According to the Congressional Oversight Panel Report, AIG's securities lending counterparties demanded the return of \$24 billion in cash collateral between September 12 and September 30, 2008 (Congressional Oversight Panel 2010, p. 45). Ultimately AIG reported losses from securities lending in excess of \$20 billion in 2008 (see Table 4), and in 2007 securities lending payables exceeded receivables by more than \$6 billion (AIG 2007b, p. 130-131).

## **Securities Lending and Bankruptcy**

What would have happened to AIG's securities lending business in the event of bankruptcy? Generally, if a securities lender seeks bankruptcy protection, the borrower

simply takes ownership of the security that it borrowed and any additional claims associated with the transaction would be resolved in bankruptcy. With daily mark-to-market of the security on loan and exchange of collateral, additional claims would typically be small. Because securities lending transactions are exempt from the automatic stay provisions of the bankruptcy code, resolving these transactions is reasonably fast and straightforward.

However, the likely resolution in an AIG bankruptcy is less clear and would have depended on the actions of state insurance regulators. AIG's securities lending was conducted largely for the benefit of its life insurance companies. When a life insurance company cannot meet its financial obligations, a state insurance commissioner will take control of the company's operations and place it in receivership.<sup>8</sup> Federal law specifically excludes insurance companies from bankruptcy proceedings, although state receivership statutes are generally patterned after federal bankruptcy. There are important exceptions, however, that may have been material for AIG in 2008.

If AIG had sought bankruptcy protection, it likely that state insurance commissioners would have seized AIG's insurance subsidiaries.<sup>9</sup> In these circumstances, the status of securities lending transactions might have varied depending on where a

---

<sup>8</sup> The state receivership process has three stages: (1) conservation, (2) rehabilitation, and (3) liquidation. The receivership process can involve transfers of blocks of assets and liabilities to other companies. If the company cannot be rehabilitated or sold, it is declared insolvent and the commissioner liquidates the company. In an insurance liquidation, the state insurance commissioner takes over the assets of the insurer, evaluates the claims of policyholders and other creditors against the insurer, and distributes assets or the proceeds from asset sales to approved claimants in the manner prescribed by the state's receivership laws.

<sup>9</sup> "If AIG had gone bankrupt, state regulators would have seized the individual insurance companies," said Eric Dinallo in a February 2, 2010, WSJ op-ed, "What I Learned at the AIG Meltdown: State regulation wasn't the problem," available at <http://online.wsj.com/articles/SB10001424052748704022804575041283535717548>.

particular AIG insurance subsidiary was located. As of 2008, only one of the ten states where AIG's life insurance subsidiaries were located had passed a version of the Insurance Resolution and Modernization Act (IRMA), which allows securities lending and other qualified financial contracts to receive the same safe harbor provisions in an insurance resolution that would apply in bankruptcy.<sup>10</sup> The counterparties to the 58% of AIG's securities lending that was conducted on behalf of Texas-domiciled life insurers would have had legal clarity through Texas's version of the IRMA law. However, the legal treatment of counterparties to the remaining 42% that was conducted on behalf of life insurers located in other states would have been uncertain in an insurance insolvency. AIG's 2007 10K points out that "the securities on loan as well as all of the assets of the participating companies are generally available to satisfy the liability for collateral received" (AIG, 2007b, p. 108).

An additional protection for some securities borrowers would have arisen from a unique aspect of AIG's lending program. Rather than the typical practice of requiring collateral of 102% of the value of the security being lent, AIG began lending securities with considerably less than 100% collateral.<sup>11</sup> AIG seems to have accelerated this practice as its liquidity issues grew more acute. For example, in an August 14, 2008, email, a Federal

---

<sup>10</sup> As of January 2012, 18 states had passed versions of IRMA. See <http://www.law360.com/articles/295760/expanding-insurance-regulation-one-state-at-a-time> and Fitch Ratings (2006).

<sup>11</sup> "Historically, under AIG's securities lending program, cash collateral was received from borrowers and invested by AIG primarily in fixed maturity securities to earn a spread. AIG had received cash collateral from borrowers of 100 to 102 percent of the value of the loaned securities. In light of more favorable terms offered by other lenders of securities, AIG accepted cash advanced by borrowers of less than the 102 percent historically required by insurance regulators. Under an agreement with its insurance company subsidiaries participating in the securities lending program, AIG parent deposited collateral in an amount sufficient to address the deficit. AIG parent also deposited amounts into the collateral pool to offset losses realized by the pool in connection with sales of impaired securities. Aggregate deposits by AIG parent to or for the benefit of the securities lending collateral pool through August 31, 2008 totaled \$3.3 billion" (AIG, 2008b, p. 3).

Reserve Bank of New York employee noted that “CSG (Credit Suisse Group) does not need the securities it borrows but instead AIG is using the deals to raise cash. As such CSG is looking to take a haircut on AIG’s securities as opposed to posting cash to AIG in excess of the securities value which is the market standard.”<sup>12</sup>

When the borrowing firm does not post enough cash to fund “substantially all of the cost of purchasing replacement assets,” the transaction will be treated as a sale rather than as a securities lending transaction from an accounting perspective. AIG reported losses of \$2.4 billion on such sales in 2008 (AIG, 2008b, p. 166). Securities borrowers who held securities worth more than the cash they were due from AIG would not have suffered losses in an AIG bankruptcy, again assuming away uncertainties associated with state insurance law. Overall, this analysis suggests that losses for AIG’s securities lending counterparties would have been small had the firm sought bankruptcy protection and if the counterparties were able to take possession of the securities that they had borrowed. Note that this conclusion only takes into account the potential for direct losses. If the counterparties needed to unwind or liquidate positions quickly, there may have been indirect losses as well.

## **Impact of Securities Lending on AIG’s Domestic Life Insurance Subsidiaries**

The AIG domestic life insurance subsidiaries that participated more heavily in securities lending suffered much larger losses in 2008 than their counterparts that

---

<sup>12</sup> [http://fcic-static.law.stanford.edu/cdn\\_media/fcic-docs/2008-09-12%20FRBNY%20Email%20re%20AIG%20Meeting%20with%20OTS.pdf](http://fcic-static.law.stanford.edu/cdn_media/fcic-docs/2008-09-12%20FRBNY%20Email%20re%20AIG%20Meeting%20with%20OTS.pdf)

participated less. Most of these losses can be attributed to two things: losses on sales of assets to meet securities lending redemptions and mark-to-market losses on similar assets.

The losses due to securities lending and mark-to-market losses on similar securities put AIG's domestic life insurance companies under considerable pressure from a regulatory capital perspective. Life insurance regulators establish minimum levels of capitals that take into account each company's asset risk, insurance risk, market risk, interest rate risk, and business risk (less an adjustment to account for the fact that these risks are not perfectly correlated). When capital falls below a certain threshold, state insurance regulators are required to intervene to protect policyholders. Table 4 shows the capital positions of AIG's life insurance subsidiaries with more than \$5 billion in assets at the end of 2007. The table shows the share of 2007 assets each company had on loan through AIG's securities lending business, the subsidiary's 2007 assets, its securities lending losses in 2008, and its regulatory capital as of the end of 2008. By this measure, AIG's subsidiaries appear to have made it through 2008 with a comfortable cushion of capital relative to regulatory minimums.

However, these figures include capital infusions that were possible because of the rescue of AIG. When we subtract out capital infusions that occurred in the third and fourth quarters of 2008, several of AIG's largest domestic life insurance companies appear to be insolvent.<sup>13</sup> The urgency of the problems in AIG's life insurance subsidiaries is reflected in the rapidity with which they were recapitalized: By September 30, 2008, just 14 days after

---

<sup>13</sup>Others have argued that the life insurance companies would have been solvent without the government rescue. For example, in testimony to the House Banking Committee, Eric Dinallo said, "We calculate that without the Federal intervention, the life insurance companies are approximately \$10 billion solvent," available at <http://www.gpo.gov/fdsys/pkg/CHRG-111shrg51303/html/CHRG-111shrg51303.htm>.

the initial loan to AIG, \$13.3 billion of the loan proceeds had gone toward recapitalizing the life insurance subsidiaries (Congressional Oversight Panel, 2010, p. 84).<sup>14</sup>

### 3. AIG's Credit Default Swap Portfolio

We now discuss AIG's credit default swap (CDS) business, with the goal of understanding the position in which AIG and its counterparties found themselves on September 16, 2008.

#### Credit Default Swaps

A credit default swap (CDS) is a derivative that is an insurance contract on a bond. The CDS writer (the insurance seller) promises to pay to the CDS buyer the difference between the market value and the par value of the insured bond if default or a "credit event" occurs.<sup>15</sup> A CDS writer can suffer a loss if there is a credit event or (on a mark-to-market basis) if the price of the CDS increases and the loss is marked-to-market for accounting purposes. The use of mark-to-market accounting was controversial during the financial crisis (see Heaton, Lucas, and McDonald, 2010), but it is standard practice for most derivatives. Mark-to-market losses on AIG's CDS contracts were \$28.6 billion in 2008 (AIG, 2008b, p. 265).

---

<sup>14</sup> These concerns are also reflected in a proposed, but never implemented, plan that would have allowed AIG to use its insurance assets to temporarily generate \$20 billion in liquidity. Under this proposal, AIG's property casualty companies would advance municipal bonds to the parent company which could then be sold or used as collateral. These advances would have been secured by the property casualty companies taking equity stakes in the life insurance subsidiaries. See Eric Dinallo's October 7, 2008, testimony to the House Committee on Oversight and Government Reform, available at <http://oversight-archive.waxman.house.gov/documents/20081007100906.pdf>.

<sup>15</sup> For our purposes, it is sufficient to think of a credit event as the failure of the bond to make a promised payment. There are many arcane details associated with derivatives and credit default swaps in particular. We will ignore the details that are not essential to our analysis.

## AIG's Credit Default Swaps

As of December 31, 2007, AIG had written credit default swaps with a notional value of \$527 billion. These swaps were written on corporate loans (\$230 billion), prime residential mortgages (\$149 billion), corporate debt/collateralized loan obligations (CLOs) (\$70 billion) and multi-sector CDOs (\$78 billion) (AIG, 2007b, p. 122). AIG also had an additional \$1.5 trillion of other derivative exposures, including over \$1 trillion in interest rate swaps. The swaps written on multi-sector CDOs proved the most troublesome. The multi-sector CDS contracts were written on collateralized debt obligations backed by prime, Alt-A, and subprime RMBS, CMBS, CDOs, and other asset-backed securities (AIG, 2008b, p. 139). It is important to realize that AIG's CDS exposure resulted in a "one-way" bet on real estate. By contrast, market-making financial firms typically both buy and sell and seek to hedge any significant directional exposure.

AIG characterized \$379 billion of the CDS, those on corporate loans and prime residential mortgages, as used for "regulatory capital relief rather than risk mitigation" (AIG, 2007b, p. 122), primarily by European banks. These appear not to have been risky; in its 2008 10-K (AIG, 2008b, p. 118), AIG reported a mark-to-market loss on this portfolio of \$379 million, 0.1% of the notional value. Moreover, AIG said it expected that the swaps would be terminated by the counterparties once they operated under the Basel II capital rules (AIG, 2007b, p. 122). This suggests that the counterparty banks considered themselves compliant with Basel II, although they were not yet regulated under those rules.

AIG began originating multi-sector CDS in 2003, at a time when the firm was rated AAA (see Table 3). Over half of AIG's cumulative CDS issuances, however, occurred after the firm was downgraded twice in 2005. Figure 1 shows AIG's monthly CDS issuance volume

from 2004 to 2007, with Fitch's downgrades to AA+ on March 15, 2005, and to AA on May 2, 2005, depicted as dashed vertical lines. Details of one of AIG's multi-sector CDS are shown in the Appendix. AIGFP reportedly decided to stop originating CDS in 2005, at which point they had \$80 billion of commitments.<sup>16</sup>

## **Collateral and Variation Margin**

In order to manage counterparty risk, derivatives counterparties typically exchange collateral as compensation for market value changes. AIG's CDS contracts were traded over-the-counter (OTC), i.e., directly with counterparties, as opposed to being traded on an exchange and cleared through a clearinghouse. The standard master agreement for OTC derivatives is provided by the International Swaps and Derivatives Association (ISDA) and includes a credit support annex (CSA), which specifies how counterparty credit risk will be addressed. Both the master agreement and CSA can be customized when negotiating a deal.

By construction, many derivatives contracts have zero market value at inception; this is generally true for futures, swaps, and credit default swaps. When a position has zero market value, the two parties to a contract can, by mutual consent, exit the contract without any obligation for either to make any further payment to the other.<sup>17</sup>

As time passes and prices move, a contract initiated with zero market value will generally not remain at zero market value: Fair value will be positive for one counterparty and negative by an exactly offsetting amount for the other. It is common for the negative value party to make a compensating payment to the positive value counterparty. Such a

---

<sup>16</sup>Written Testimony of Scott M. Poltokoff to the House Committee on Banking, Housing, and Urban Affairs, March 5, 2009, p. 5.

<sup>17</sup>Note that one or both parties may be using the contract to hedge a position, in which case exiting would leave unhedged risk.

payment is referred to as *margin* or *collateral*; the two terms mean the same thing.<sup>18</sup>

Collateral can flow back and forth as market values change and is returned if the loss is ultimately not realized. When full variation margin is exchanged, *the value of the contract is regularly reset to zero*, meaning that the counterparties can agree to exit the contract without any further payments.<sup>19</sup>

## AIG's Collateral Practices

Most of the CDS contracts written by AIG did not call for full exchange of variation margin. Rather, they carried a wide range of collateral provisions, details of which are summarized in AIG (2007c and 2007d). Some contracts made no provision for any exchange of collateral. Most often, AIG would make collateral payments only if the decline in value of the insured assets was large enough, exceeding a predefined threshold. Thresholds often depended on AIG's credit rating, which meant that a corporate ratings downgrade could lead to a large required collateral payment.

The post-crisis investigation shed light on AIG's collateral arrangements with various counterparties. These examples (AIG, 2007d) from December 2007 illustrate agreements ranging from full mark-to-market to an 8% threshold with various credit rating triggers:

---

<sup>18</sup>Technically, payments due to market value changes are *variation margin*. Another use of collateral is to protect against possible future market value changes. This kind of collateral, called "initial margin" or the "independent amount," is typically not used in OTC markets in dealer-to-dealer transactions and is not relevant for discussing AIG.

<sup>19</sup>Note that a transfer of funds based on a market value change is classified as collateral and not simply as a payment. The reason is that the contract has not settled, so collateral is held by one party against the *prospect* of a loss at the future date when the contract does finally settle. If the contract ultimately does not generate the loss implied by the market value change, the collateral is returned. The accounting treatment of collateral recognizes this description, and the reporting of collateral on the balance sheet depends upon the existence of a master netting agreement.

- **RBS** had four transactions with AIG, with a total notional value of \$1.35 billion. AIG had to make variation payments for any market value change; the “threshold” (level of market value change required to trigger a collateral payment) was zero (AIG, 2007d, p. 6).
- **Goldman Sachs** had 44 transactions with AIG, with a total notional value of \$17.09 billion. The threshold was “4% as long as AIGFP is rated in the AA/Aa category” (AIG, 2007d, p. 4).
- **Merrill Lynch** had 22 transactions with AIG, with a total notional value of \$9.90 billion. The threshold was “8% as long as AIGFP is rated AA/Aa2 and Reference Obligation is rated at least in the AA/Aa category; the Threshold is reduced based on a matrix that takes into account lower ratings of AIGFP and/or the Reference Obligation” (AIG, 2007d, p. 5).

The underlying assets were illiquid. As a consequence, there were running disagreements between AIG and its counterparties about their value and hence the amount of collateral that AIG owed counterparties.<sup>20</sup>

Collateral agreements can have real effects. With full payment of mark-to-market variation margin (a zero threshold), the contract is regularly reset to zero and counterparties can exit a contract at any time without having to make payments to one another. Moreover, full mark-to-market variation margin means that neither party can accumulate unfunded losses: Credit exposure of parties to one another is minimized.

By comparison, with non-zero thresholds, AIG could and did accumulate unpaid losses. The size of the unpaid losses depended on the terms in the CSA. An unpaid variation

---

<sup>20</sup>The FCIC documents detail disagreements between AIG and Goldman about prices of underlying assets.

amount is economically equivalent to a loan from the counterparty to AIG. If AIG has \$1 billion in unpaid variation margin, it is as if AIG borrowed \$1 billion from the counterparty. Non-zero thresholds create debt overhang: The party incurring losses may be unwilling to exit the contract because doing so would force it to make full collateral payments. Presumably this is why many CSAs also contain provisions that allow the CDS purchaser to terminate the CDS if the CDS issuer is downgraded.

Table 5 outlines the evolution of collateral calls related to AIG's CDS on multi-sector CDOs for Goldman Sachs and Societe Generale (AIG's two largest CDS counterparties), as well as for all counterparties combined. The difference between the collateral call and collateral posted peaked at \$12.4 billion on September 15, 2008, the date when AIG was downgraded below AA-.

AIG first reported a loss on CDS in 2007, losing \$11.5 billion on all CDS for the year—\$11.1 billion in the fourth quarter alone—with 98% of the total loss for the year coming from CDS on multi-sector CDOs (AIG, 2007b, p. 83).<sup>21</sup> Losses continued in 2008. The effect of ratings triggers is evident in a comparison of collateral calls for September 12, 2008, and those for September 15, 2008, the day on which all three ratings agencies downgraded AIG. Total collateral calls increased by \$8.6 billion, with Societe Generale alone accounting for more than half of that increase.

## **What if AIG Had Declared Bankruptcy?**

---

<sup>21</sup>AIG's CDS business was barely disclosed prior to 2007: The phrase "super senior" appears four times in the 2006 annual report and 114 times in 2007; "multi-sector" does not appear in 2006, but appears 23 times in 2007; "CDO" appears twice in 2006 and 93 times in 2007. AIG's 2006 annual report discloses that it had written \$483.6 billion in CDS, but provides no details, whereas the 2007 report reports notional values of CDS by category. AIG's first public disclosure of CDS written on the multi-sector CDOs came on August 9, 2007, during a second-quarter earnings call (FCIC, 2011, p. 268). The lack of disclosure is bemusing given that the CDS transactions increased the size of AIG's economic balance sheet by 50%.

What would have been the direct effect on CDS counterparties had AIG declared bankruptcy on September 16, 2008? It is of course impossible to answer this question, but some straightforward observations are possible.

AIG had 21 counterparties for its multi-sector CDS. Of those, nine had collateral calls exceeding \$500 million, and six of those—Goldman Sachs, Societe Generale, Merrill, UBS, DZ Bank, and Rabobank—had a difference between called collateral and posted collateral exceeding \$500 million.<sup>22</sup> Table 6 shows that, of the total \$11.4 billion AIG owed to counterparties, those six banks accounted for \$10 billion.

There would most likely have been three direct consequences for counterparties of the multi-sector CDOs if AIG had defaulted:

1. Banks would have kept the collateral already posted.<sup>23</sup>
2. Banks would have been general creditors for called but unposted collateral.
3. Banks would have retained the asset or position hedged by the defaulted CDS.

Assuming that assets were valued correctly and that the September 15, 2008 downgrade to an A rating eliminated remaining thresholds, the economic cost of a default would be the collateral shortfall: the difference between called and posted collateral. How significant would the shortfall have been for counterparties? Table 6 shows the shortfall relative to equity for the six banks individually owed more than \$500 million. In no case did the shortfall exceed 10% of counterparty capital.

Comparing the actual loss with counterparty equity presumes that counterparties would simply absorb the loss. There are at least two potential problems with this scenario.

---

<sup>22</sup>The calculations here rely on an FCIC document entitled “AIG/Goldman-Sachs Collateral Call Timeline,” available at <http://fcic.law.stanford.edu/documents/view/2172>.

<sup>23</sup>This is a consequence of derivatives being exempted from the automatic stay in bankruptcy. See Edwards and Morrison (2005) and Bolton and Oehmke (forthcoming).

First, Brunnermeier and Pedersen (2009) and Duarte and Eisenbach (2013), among others, emphasize the possibility of fire-sale spillovers. Institutions could respond to a loss by selling assets so as to reduce leverage. This could lower prices and result in widespread asset sales. Second, the cancellation of CDS would leave many of the counterparties with unhedged exposure to real estate risk. Retaining this risk could reduce the capacity for risk-taking, while selling the positions in a fire sale could increase losses.

Another consequence of an AIG failure would have been cancellation of the \$387 billion of regulatory capital swaps. We are unaware of collateral calls on these swaps, and as noted above, the institutions were apparently anticipating the swaps to expire when they adopted Basel II capital rules. The swap cancellation would have created a capital deficiency, but it is not clear that this would have been economically important. In any event, European regulators would have had the option to forebear.

One should keep in mind that other market participants did not know the counterparty exposures we present here. This is not particular to CDS, however, but is true for debt positions generally.

#### **4. Performance of Maiden Lane Assets**

AIG's failure is often described as a liquidity event, but the firm sustained a loss of \$99 billion in 2008, which raises a question about the relative roles of illiquidity and insolvency (AIG, 2008b, p. 36). Illiquidity in this context can refer either to idiosyncratic or aggregate illiquidity. Idiosyncratic illiquidity could mean that AIG was solvent in the long run, but lacked the liquid assets or ability to borrow in order to satisfy short-term cash needs. Aggregate illiquidity would mean that economic events temporarily depressed

prices of assets (in particular real-estate-related assets). The second interpretation has the clear implication that prices of AIG's assets should have recovered after the crisis ended.

The Federal Reserve Bank of New York created two special purposes vehicles as part of the rescue of AIG: Maiden Lane II, which purchased the remaining securities lending invested collateral from AIG; and Maiden Lane III, which acquired the CDOs that AIG had insured from AIGFP's counterparties, terminating the associated CDS. The New York Fed thoroughly documented the resulting cash flows and thus provides data that bears on how the value of these securities evolved during the period in which the Maiden Lane vehicles were operational. These data, in combination with information from Bloomberg, allow us to examine amortizations and write-downs from origination to the present.

### **Maiden Lane II and III Performance**

The New York Fed managed the Maiden Lane vehicles and assets with the goal of selling the assets once markets stabilized. Both Maiden Lane vehicles were ultimately liquidated and a gain was reported on both vehicles. Our examination of these transactions shows that while on average prices recovered somewhat, most of the Maiden Lane assets were liquidated at prices well below par, with sales occurring one to four years after the securities were acquired. The performance of the Maiden Lane assets was sufficient for the New York Fed to report a total gain of approximately \$9.5 billion on the two transactions.

Tables 7 and 8 display summary statistics for the two Maiden Lane portfolios. Maiden Lane II assets were smaller, were bought and sold at a higher percentage of face

value, and had smaller gains relative to the Maiden Lane III assets.<sup>24</sup> It is difficult to measure the performance of the two portfolios because the assets were amortizing and were sold at different times, with the Maiden Lane III portfolio being liquidated later on average. To control for the different liquidation times, we report the return normalized by subtracting the return on the ABX.HE.AAA.06-1 index for Maiden Lane II, an index of securitized subprime mortgage loans originated in the last six months of 2005. Because Maiden Lane III includes exposure to commercial real estate loans, for this portfolio we normalize returns using a 70% weighting on the ABX and a 30% weighting on the CMBX.NA.AAA.6, an index of securitized commercial real estate loans. It is worth noting that AIG had begun to sell its securities lending collateral prior to the creation of Maiden Lane II, and the securities acquired by the SPV were likely the poorest assets.

The performance of the Maiden Lanes was driven in part by the vintage of the underlying assets. In Maiden Lane II, 78% of the original face value of the underlying portfolio of RMBS were issued in 2006 or 2007 (authors' calculations) and mortgages originated in those years have experienced particularly high delinquency rates (see Demyanyk and Van Hemert, 2011).<sup>25</sup>

## Post-Maiden-Lane Performance

---

<sup>24</sup> The New York Fed's data on the Maiden Lane vehicles are available at <http://www.newyorkfed.org/markets/maidenlane.html>. The data include the CUSIP, purchase price, sale price, sale date, and total cash flows for each asset while held by the New York Fed.

<sup>25</sup> AIG's investments of securities lending collateral in real-estate-related instruments accelerated after 2005. On the other hand, AIGFP decided to stop increasing its exposure to real-estate-related risk near the end of 2005. Despite this decision, deals that were in the pipeline continued, and AIGFP's real estate exposure continued to grow until about mid-2006. In addition, some of the CDOs that AIGFP insured were actively managed, which meant that the CDO manager could replace maturing, refinanced, and defaulting mortgages with new ones, including mortgages that were underwritten in 2006 and 2007.

Table 9 shows the performance from origination through September 2014, or the latest date for which data are available, for subsets of the RMBS that eventually became part of Maiden Lane II and the super senior tranches of the CDOs that were insured by AIGFP and eventually became part of Maiden Lane III.<sup>26</sup> Because incoming interest and principal are applied first to senior tranches, senior tranches will be the last to experience actual losses. For this reason, we expect actual losses to appear late and to increase over time. The table provides information at four points: at origination, when the Maiden Lane vehicles were created, when the assets were sold from the Maiden Lane vehicles (various dates), and the most recent information. Fifty-four percent of the Maiden Lane II and 12% of the Maiden Lane III securities have experienced write-downs. The bulk of write-downs have occurred during the post-Maiden Lane period.

Reported write-downs to date are 8.3% for Maiden Lane II and 1.3% for Maiden Lane III.<sup>27</sup> However, for the securities in Maiden Lane III, write-down information is only available for those that Bloomberg classifies as “paid-off.” For these Maiden Lane III securities, for which principal has been paid off (which could be because scheduled payments have been made and the asset has matured, because they underlying loans have

---

<sup>26</sup> Table 9 reports the total aggregate performance of the assets that were included in the Maiden Lane vehicles, but the amount held by the Maiden Lanes may differ from the amounts implicit in Table 9. Thus, totals do not match the investments reported by the Federal Reserve Bank of New York. The table excludes Maiden Lane II assets that Bloomberg labels “implied loss bonds” as these bonds lack write-down data. This accounts for approximately one-half of the CUSIPS in Maiden Lane II. Our analysis to date suggests that these bonds are likely to experience similar losses to the securities included in the table. The table also excludes two Maiden Lane III CDOs that were unwound into their component parts by the financial institutions that acquired them from Maiden Lane III. See <http://www.reuters.com/article/2012/04/13/maidenlane-cdos-idUSL2E8FDHV520120413>

<sup>27</sup> It is our understanding that write-downs are recorded only at maturity for some securities, particularly for CDOs, so these figures are likely to underestimate losses for the Maiden Lane III securities.

been restructured and paid off, or because the principal has been written down to zero due to losses), write-downs are 5.6%. Using more complete data and analyzing a larger number of CDOs, Cordell, Huang and Williams (2012) report average write downs of 26% for the super senior tranches of CDOs originated in 2004 and 44% for 2005 originations.

Given the low prices reported in Tables 7 and 8 and the share of securities that have experienced write-downs, it should not be surprising that virtually all of the assets acquired by the Maiden Lanes have suffered rating downgrades. While the vast majority of the securities in both Maiden Lanes were originally rated AAA, their latest ratings are considerably lower. Figure 3 shows the ratings at origination as well as the most recent rating from Moody's.

The AIG-specific and market-wide liquidity concerns that prompted the creation of the Maiden Lane vehicles may have been resolved, but delinquencies on the underlying loans have continued, resulting in additional write-downs after the Maiden Lane vehicles were wound down. This suggests that AIG faced both liquidity and solvency issues in 2008.

## **5. Conclusions**

AIG's near-failure was a result of two large bets on real estate whose funding proved vulnerable. First, AIG used securities lending to transform insurance company assets into RMBS and CDOs, ultimately losing \$21 billion and threatening the solvency of the life insurance companies. The securities lending business was characterized by a large liquidity and maturity mismatch, making it vulnerable to borrowers redeeming en masse. On one day in 2008, AIG faced a \$5.2 billion redemption.

Second, AIG sold insurance on real-estate-backed multi-sector CDOs, ultimately losing more than \$30 billion and facing a one-day \$8.6 billion collateral demand due to a downgrade. Insurance companies are traditionally less vulnerable to financial crises, in part because they do not rely heavily on short-term funding. AIG did, through its securities lending and through AIGFP's collateral practices.<sup>28</sup>

AIG's liabilities became more "bank-like" and subject to rollover risk at the same time that its assets became more opaque and illiquid, and again more bank-like, increasing its vulnerability to a shock. This transformation from a traditional insurance company, with stable funding and liquid assets in the form of bonds and stocks, to a bank-like firm that relied heavily on short-term funding and had significant exposure to opaque and illiquid assets in the form of RMBS and CDOs related to securities lending and CDS writing ultimately proved disastrous.

Much of the discussion about the crisis has focused on liquidity versus solvency. The two cannot always be disentangled, but an examination of the performance of AIG's underlying real estate securities indicates that AIG's problems were not purely about liquidity. The assets represented in both Maiden Lane vehicles have experienced write-downs that disprove the claim that they are money-good. While it may seem obvious with the benefit of hindsight that not all of these securities would make their scheduled interest and principal payments in every state of the world, the belief that they could not suffer

---

<sup>28</sup> This is in addition to AIG's reliance on short-term funding in the form of commercial paper, which it was unable to renew in the days leading up to September 16, 2008 (Congressional Oversight Panel, 2010, p. 61).

solvency problems and that any price decline would be temporary and due to illiquidity was an important factor in their creation and purchase.

## References

- Acharya, Viral V., Douglas Gale, and Tanju Yorulmazer, 2011, Rollover risk and market freezes, *Journal of Finance* 66, 1177–1209.
- Acharya, Viral, Philip Schnabl and Gustavo Suarez. 2013. "Securitization Without Risk Transfer." *Journal of Financial Economics* 107: 515-536.
- Adrian, Tobias, Brian Begalle, Adam Copeland and Antoine Martin. 2013. "Repo and Securities Lending" Federal Reserve Bank of New York Staff Report 529.
- Aggarwal, Reena, Pedro A. C. Saffi and Jason Sturgess. 2012. "Role of Institutional Investors in Voting: Evidence from the Securities Lending Market" Georgetown McDonough School of Business Research Paper No. 2012-07.
- American International Group. 2007a. "Form 10-Q quarterly report for the quarterly period ended September 30, 2007." *AIG Investor Relations*. <http://services.corporate-ir.net/SEC/Document.Service?id=P3VybD1hSFIwY0RvdkwyRndhUzUwWlc1cmQybDZZWEprTG1OdmJTOWtiM2R1Ykc5aFpDNXdhSEEvWVdOMGFXOXVQVkJFUmlacGNHRm5aVDAxTWpZd05EQTRKbk4xWW5OcFpEMDFOdz09JnR5cGU9MiZmbj1BbWVyaWNhbkludGVybmF0aW9uYWxHcm91cF8xMFFfMjAwNzExMDcucGRm>.
- American International Group. 2007b. "Form 10-K annual report for the fiscal year ended December 31, 2007." *AIG Investor Relations*. <http://services.corporate-ir.net/SEC/Document.Service?id=P3VybD1hSFIwY0RvdkwyRndhUzUwWlc1cmQybDZZWEprTG1OdmJTOWtiM2R1Ykc5aFpDNXdhSEEvWVdOMGFXOXVQVkJFUmlacGNHRm5aVDAxTlRBd016azVKbk4xWW5OcFpEMDFOdz09JnR5cGU9MiZmbj1BbWVyaWNhbkludGVybmF0aW9uYWxHcm91cF8xMETfMjAwODAyMjgucGRm>.
- American International Group. 2007c. "AIG Status of Collateral Call Postings." *FCIC Resource Library*. [http://fcic-static.law.stanford.edu/cdn\\_media/fcic-docs/2007-12-31\\_AIG\\_Status\\_of\\_Collateral\\_Call\\_Postings.pdf](http://fcic-static.law.stanford.edu/cdn_media/fcic-docs/2007-12-31_AIG_Status_of_Collateral_Call_Postings.pdf).
- American International Group. 2007d. "AIG Super Senior Credit Transactions - Principal Collateral Provisions." *FCIC Resource Library*. [http://fcic-static.law.stanford.edu/cdn\\_media/fcic-docs/2007-12-07%20AIG%20Super%20Senior%20Credit%20Transactions-%20Principal%20Collateral%20Provisions.pdf](http://fcic-static.law.stanford.edu/cdn_media/fcic-docs/2007-12-07%20AIG%20Super%20Senior%20Credit%20Transactions-%20Principal%20Collateral%20Provisions.pdf).
- American International Group. 2008a. "Form 10-Q quarterly report for the quarterly period ended June 30, 2008." *AIG Investor Relations*. <http://services.corporate-ir.net/SEC/Document.Service?id=P3VybD1hSFIwY0RvdkwyRndhUzUwWlc1cmQybDZZWEprTG1OdmJTOWtiM2R1Ykc5aFpDNXdhSEEvWVdOMGFXOXVQVkJFUmlacGNHRm5aVDAxT0RFek9UTTJKbk4xWW5OcFpEMDFOdz09JnR5cGU9MiZmbj1BbWVyaWNhbkludGVybmF0aW9uYWxHcm91cF8xMFFfMjAwODA4MDYucGRm>.
- American International Group. 2008b. "Form 10-K annual report for the fiscal year ended December 31, 2008." *AIG Investor Relations*. <http://services.corporate-ir.net/SEC/Document.Service?id=P3VybD1hSFIwY0RvdkwyRndhUzUwWlc1cmQybDZZWEprTG1OdmJTOWtiM2R1Ykc5aFpDNXdhSEEvWVdOMGFXOXVQVkJFUmlacGNHRm5aVDAxT0RFek9UTTJKbk4xWW5OcFpEMDFOdz09JnR5cGU9MiZmbj1BbWVyaWNhbkludGVybmF0aW9uYWxHcm91cF8xMFFfMjAwODA4MDYucGRm>.

[ir.net/SEC/Document.Service?id=P3VybD1hSFIwY0RvdkwyRndhUzUwWlc1cmQybDZZWEprTG1OdmJTOWtiM2R1Ykc5aFpDNXdhSEEvVvdOMGFXOXVQVkJFUmlacGNHRm5aVDAyTVRjek1qZ3dKbk4xWW5OcFpEMDFOdz09JnR5cGU9MiZmbj1BbWVyaWNhbkludGVybmf0aW9uYWxHcm91cF8xMETfMjAwOTAzMdlucGRm](http://ir.net/SEC/Document.Service?id=P3VybD1hSFIwY0RvdkwyRndhUzUwWlc1cmQybDZZWEprTG1OdmJTOWtiM2R1Ykc5aFpDNXdhSEEvVvdOMGFXOXVQVkJFUmlacGNHRm5aVDAyTVRjek1qZ3dKbk4xWW5OcFpEMDFOdz09JnR5cGU9MiZmbj1BbWVyaWNhbkludGVybmf0aW9uYWxHcm91cF8xMETfMjAwOTAzMdlucGRm).

Bank of England. 2010. "Securities Lending: An Introductory Guide," [http://www.bankofengland.co.uk/markets/gilts/sl\\_intro\\_green\\_9\\_10.pdf](http://www.bankofengland.co.uk/markets/gilts/sl_intro_green_9_10.pdf).

Ben S. Bernanke, Testimony Before the Committee on Financial Services U.S. House of Representatives, Washington, D.C., March 24, 2009.

Brunnermeier, Markus. K. and Lasse H. Pedersen. 2009. "Market Liquidity and Funding Liquidity." *Review of Financial Studies* 22(6): 2201-2238.

Congressional Oversight Panel. 2010. "June Oversight Report: The AIG Rescue, Its Impact on Markets, and the Government's Exit Strategy." <http://cybercemetery.unt.edu/archive/cop/20110402010341/http://cop.senate.gov/documents/cop-061010-report.pdf>.

Cordell, Larry, Yilin Huang and Meredith Williams. 2012. "Sizing and Assessing the Subprime CDO Damage." Federal Reserve Bank of Philadelphia Working Paper 11-30/R.

Demyanyk, Yulia and Otto Van Hemert. 2011. "Understanding the Subprime Mortgage Crisis." *Review of Financial Studies* 24(6): 1848-1880.

Duarte, Fernando and Thomas M. Eisenbach. 2014. "Fire-sale Spillovers and Systemic Risk," Federal Reserve Bank of New York Staff Report 645.

Duffie, Darrell. (1999). "Credit Swap Valuation." *Financial Analysts Journal* 55(1): 73-87.

Ellul, A., Jotikasthira, C., Lundblad, C. T. and Wang, Y. (2014), Mark-to-market accounting and systemic risk: evidence from the insurance industry. *Economic Policy*, 29: 297-341.

Fitch Ratings. 2006. "[Legal Status of Derivative Counterparties in U.S. Insurance Company Insolvencies Remains Murky, Increases Risk](#)".

Financial Crisis Inquiry Commission. 2011. "The Financial Crisis Inquiry Report: Final Report of the National Commission on the Causes of the Financial and Economic Crisis in the United States." *FCIC Resource Library*. [http://fcic-static.law.stanford.edu/cdn\\_media/fcic-reports/fcic\\_final\\_report\\_full.pdf](http://fcic-static.law.stanford.edu/cdn_media/fcic-reports/fcic_final_report_full.pdf).

Government Accountability Office. 2011. "Review of Federal Reserve System Financial Assistance to American International Group, Inc." <http://www.gao.gov/products/GAO-11-616>.

Heaton, John C, Deborah Lucas and Robert L. McDonald. 2010. "Is Mark-to-Market Accounting Destabilizing? Analysis and Implications for Policy." *Journal of Monetary Economics* 57(1): 64-75.

International Swaps and Derivatives Association. 2010. "Market Review of OTC Derivative Bilateral Collateralization Practices." [http://www.isda.org/c\\_and\\_a/pdf/Collateral-Market-Review.pdf](http://www.isda.org/c_and_a/pdf/Collateral-Market-Review.pdf).

Kacperczyk, Marcin and Philipp Schnabl. 2010 "When Safe Proved Risky: Commercial Paper During the Financial Crisis of 2007-2009." *Journal of Economic Perspectives* 24(1): 29-50.

Pierce, Hester. 2014. "Securities Lending and the Untold Story in the Collapse of AIG." George Mason University, Mercatus Center Working Paper No.14-12.

Price Waterhouse Coopers. 2007. "AIG07 SSOO PwC 3Q07 Critical Matter - Super Senior CDS." [http://fcic-static.law.stanford.edu/cdn\\_media/fcic-docs/2007-11-07%20PWC%20Memo%20PWC-FCIC%20000224-240.pdf](http://fcic-static.law.stanford.edu/cdn_media/fcic-docs/2007-11-07%20PWC%20Memo%20PWC-FCIC%20000224-240.pdf)

## Appendix

### Calculating the ABX return

In order to compare Maiden Lane returns to ABX returns, we compute a comparable return for the latter. The Markit ABX data report an index price and the remaining principal of underlying MBS. To calculate the implied ABX return, suppose that a CDO with face value  $F_t$  on date  $t$  is purchased for  $x_1 F_1$  on date 1 and sold at a later date for  $x_2 F_2$ . Suppose that total net cash flows from principal and interest are  $C$  and that there are no write-downs, only principal repayments. The principal repayment is the difference in face values, or  $F_1 - F_2$ , so that interest is  $I = C - (F_1 - F_2)$ . We can decompose the net transaction cash flow as follows:

$$x_2 F_2 + C - x_1 F_1 = (x_2 - x_1) F_2 + I + (1 - x_1)(F_1 - F_2)$$

The first term on the right is the capital gain on remaining principal, the second is interest, and the third is the capital gain on paid-down principal.

Interest on the ABX position is computed as LIBOR plus 18 basis points. We accrue stated 3-month LIBOR on a daily basis. Obviously, this is an approximation (for a given security, LIBOR would be fixed for a period of time), but it captures swings in LIBOR. In any event, interest is small compared with capital gains and losses.

Thus, the ABX return has three components:

1. Interest on the underlying securities plus the ABX premium.
2. The capital gain or loss on the portion of the securities that is not paid down, which can be inferred from the “Composite.Price” variable.
3. The paid-down portion, which can be inferred from the “Index.Factor” variable.

The sum of these three is the ABX return between any two dates.

### Example: Adirondack CDO

Adirondack was a \$1.5 billion multi-sector CDO created by Goldman Sachs in 2005, and the AAA-rated tranches were insured by AIG. The Adirondack prospectus stated that a AAA rating for the senior tranches was a precondition for issuance and that the proceeds from issuance would be used to purchase RMBS (78.7%), CMBS (9.2%), CDOs (8.1%), ABS (1%), REITs (3%), and Synthetics (12.1%, of which 29.4% are RMBS, 21.7% are CMBS, and 48.9% are CDOs).<sup>29</sup>

The table shows the various tranches of the CDO, the interest they would pay, and the maturity date of each tranche. The CP notes (in the last row of the table) contained a put

---

<sup>29</sup>See p. 25 of the FCIC report at [http://fcic-static.law.stanford.edu/cdn\\_media/fcic-docs/2005-03-00\\_Adirondack%202005-1\\_CDO%20Offering%20Circular.pdf](http://fcic-static.law.stanford.edu/cdn_media/fcic-docs/2005-03-00_Adirondack%202005-1_CDO%20Offering%20Circular.pdf).

agreement, under which Societe Generale was obligated to buy additional A-1 LT-a notes at par, with the proceeds used to repay the notes. AIG wrote CDS on the two senior most tranches, the A-1 LT-a Floating Rate tranche, which paid 32 basis points above LIBOR, and the CP Notes, which were intended to pay LIBOR.

#### Details of Adirondack 2005-1 offering

Tranche Description	Amount (\$B)	Interest (LIBOR + )	Due
A-1 LT-a Floating Rate	267.5	0.32%, 0.34% after July 2008	2040
A-2 Floating rate	60.8	0.40%	2040
B Floating rate	57.7	0.58%	2040
C Floating rate	30.4	1.40%	2040
D Floating rate	24.3	2.75%	2040
E Floating rate (optional)	5	>=2.75%	2040
CP Notes	1070.1	0	< 270 days
A-1 LT-b Floating rate	?	0.32%, 0.34% after July 2008	2040
Total	1515.8		

Source: Adirondack 2005-1 CDO Offering Circular, FCIC. [http://fcic-static.law.stanford.edu/cdn\\_media/fcic-docs/2005-03-00\\_Adirondack%202005-1\\_CDO%20Offering%20Circular.pdf](http://fcic-static.law.stanford.edu/cdn_media/fcic-docs/2005-03-00_Adirondack%202005-1_CDO%20Offering%20Circular.pdf).

#### Return on Adirondack while held by Maiden Lane III

We now consider the return on Adirondack.

##### Purchase

In November and December 2008, Maiden Lane III acquired two components of the Adirondack 2005-1 multi-sector CDO: \$141,441,297 of the A-1LT tranche, at a cost of \$82,160,881 (which is 58% of face value); and \$913,089,653 of the CP, at a cost of \$525,943,376 (58% of face value). On November 25, the ABX-HE.AAA-06-01 had a composite price of 76.54.

##### Sale

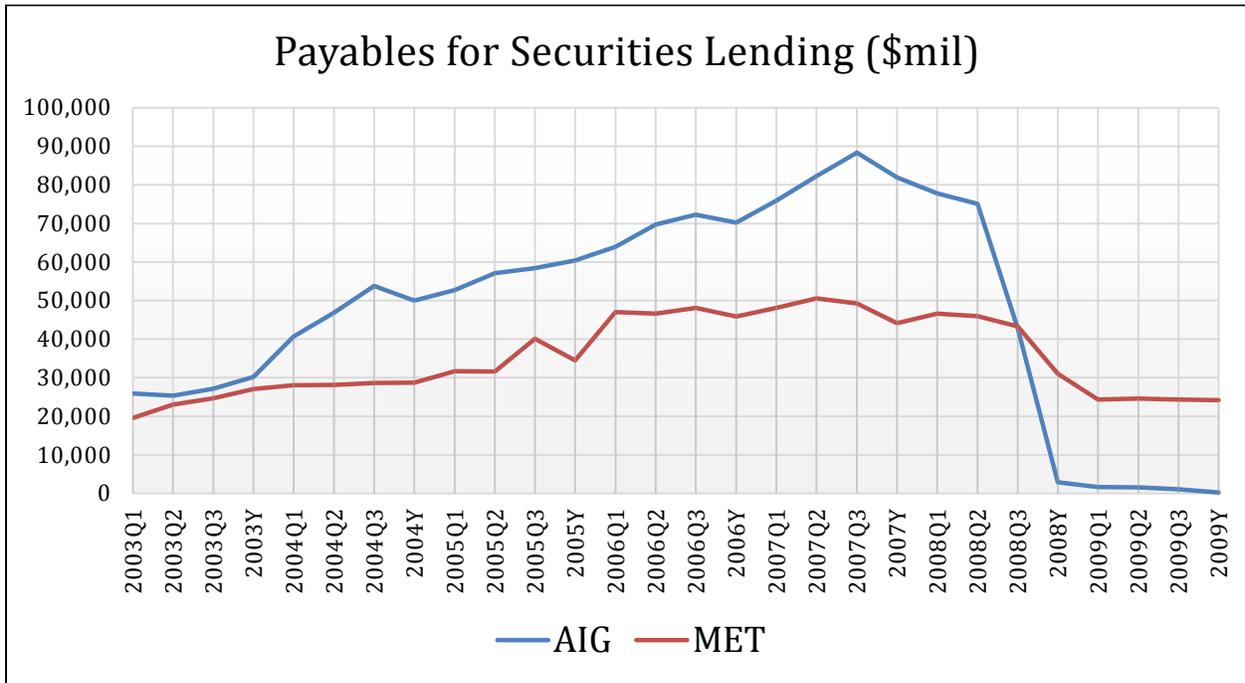
The Adirondack securities were sold on July 24, 2012. The A-1LT tranche on that date had a face value of 92,675,758, so that 48,765,539 had been paid off. The price was 62% of face value. The total net cash flow was 51,749,469. On July 24, the ABX-HE.AAA-06-01 had a composite price of 91.12.

We can think about the gain on Adirondack A-1LT as follows. The New York Fed paid \$82,160,881 and it received \$38,841,962 from principal repayments, \$2,983,930 in interest, and \$3,425,371 in capital gains on the remaining value of the bond.

The Fed reported a large gain on this transaction because a substantial portion of the CDO principal was repaid while it held the CDO.

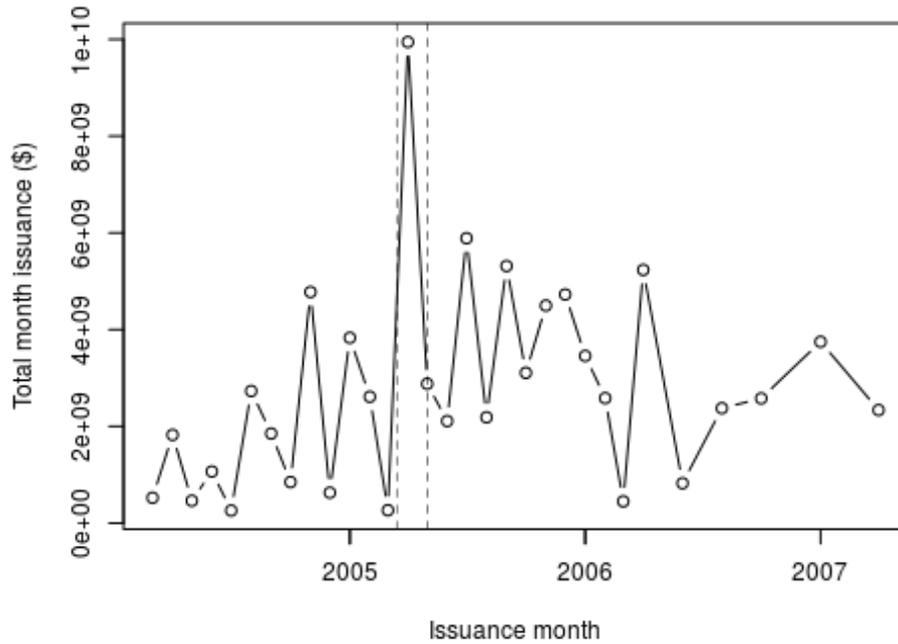
At the same time, the ABX.HE.AAA index recovered from a composite price of 76.54 on November 24, 2008, to a price of 91.12 on July 24, 2012.

**Figure 1: AIG and Metlife: Payables for Security Lending, 2003 - 2009**



Source: Authors' calculations using regulatory filing data accessed through SNL Financial.

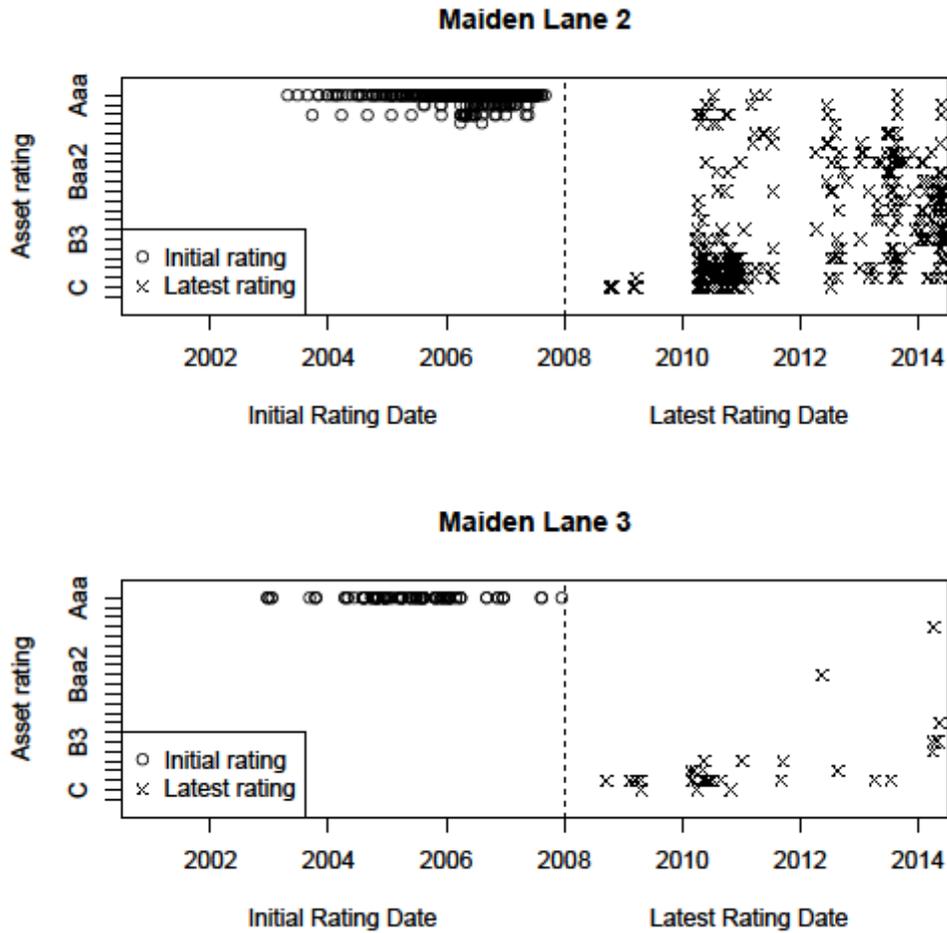
**Figure 2: Multi-sector CDS issuance by AIG from 2004 to 2007, aggregated by month. Ratings downgrades are indicated by dashed vertical lines.**



Source: FCIC, AIG internal document.

**Figure 3: Initial and Most Recent Ratings of ML II and ML III Assets**

Source: Authors' calculations using data from the Federal Reserve Bank of New York and Bloomberg.

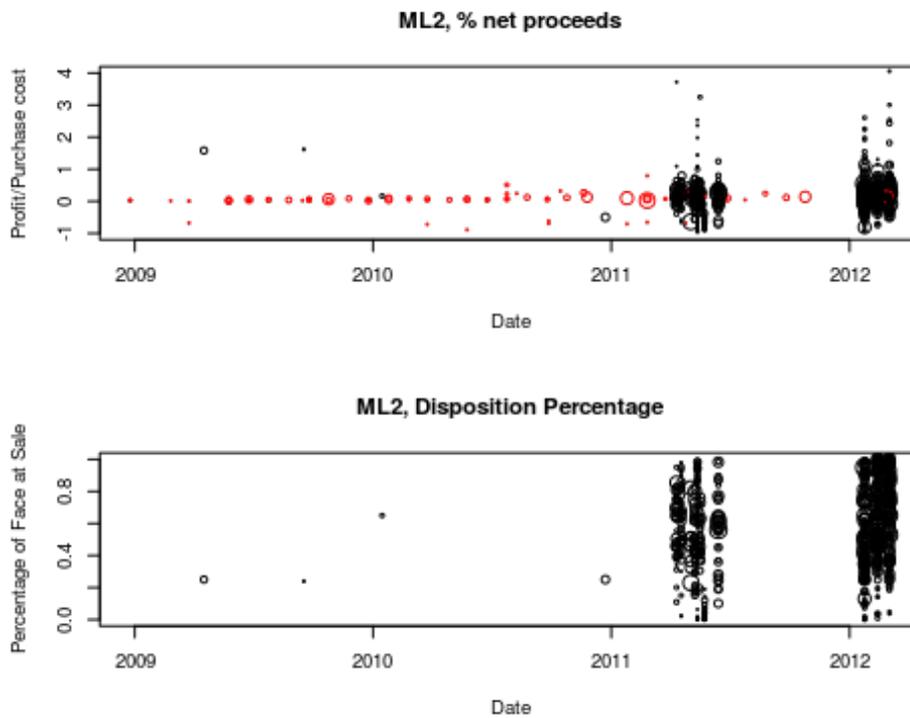


Source: Federal Reserve Bank of New York and Bloomberg.

### Figure 4: Sales of assets in Maiden Lane II

The top panel shows net proceeds (cash flows less initial cost) as a percentage of the purchase cost. The area of each point is proportional to the dollar purchase cost, and points in red represent transactions that were paid off or written down. The bottom panel shows the sale price as a percentage of face value.

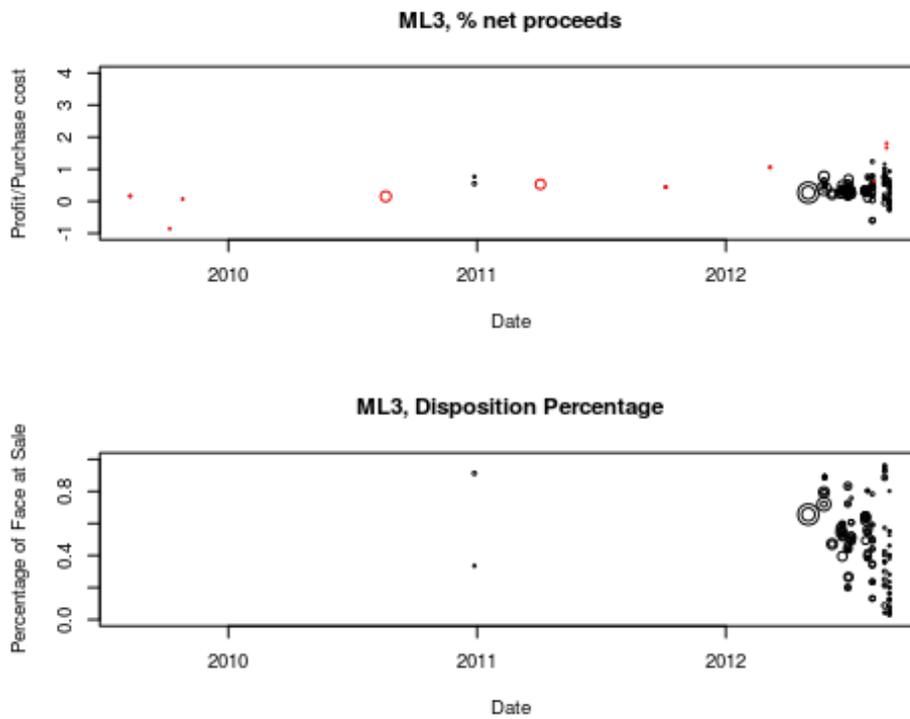
Source: Authors' calculations using data from the Federal Reserve Bank of New York and Bloomberg.



### Figure 5: Sales of assets in Maiden Lane III

The top panel shows net proceeds (cash flows less initial cost) as a percentage of the purchase cost. The area of each point is proportional to the dollar purchase cost, and points in red represent transactions that were paid off or written down. The bottom panel shows the sale price as a percentage of face value.

Source: Authors' calculations using data from the Federal Reserve Bank of New York and Bloomberg.



**Table 1: Real Estate Exposure and Leverage**

**AIG, MetLife, Citigroup, Bank of America, and JPMorgan Chase, year-end 2007, \$ Billion**

	AIG	MetLife	Citigroup	BofA	JPM
<b>Real Estate Exposure</b>					
MBS	124.1	74.2	63.1	174.0	67.1
Non-Securitized Residential	2.2	1.0	307.1	274.9	56.0
Non-Securitized Commercial	17.1	35.5	6.4	61.3	15.5
Real Estate	9.9	6.8	0.9	4.7	0.0
Off-balance sheet ABCP			97.5	54.2	63.4
CDS on Residential Mortgage	149.0				
CDS on Multi-Sector CDOs	78.0				
<b>Total real estate exposure</b>	<b>380.3</b>	<b>117.5</b>	<b>475.0</b>	<b>569.1</b>	<b>202.0</b>
<b>Equity</b>	<b>95.8</b>	<b>35.2</b>	<b>113.6</b>	<b>146.8</b>	<b>123.2</b>
Reported Assets	1060.5	558.6	2187.6	1715.7	1562.1
Adjusted Assets	1587.5	558.6	2285.2	1770.0	1625.6
Reported Leverage	11.1	15.9	19.3	11.7	12.7
Adjusted Leverage	16.6	15.9	20.1	12.1	13.2
Real estate as % of Adjusted Assets	24%	21%	21%	32%	12%
Real estate as % of Equity	397%	334%	418%	388%	164%

Sources: MBS and real estate values for MetLife, Citigroup, BofA, and JPM are from 2007Q4 bank holding company data accessed via the Federal Reserve Bank of Chicago website:

[http://www.chicagofed.org/webpages/banking/financial\\_institution\\_reports/bhc\\_data.cfm](http://www.chicagofed.org/webpages/banking/financial_institution_reports/bhc_data.cfm).

Values for off-balance sheet ABCP come from Philipp Schnabl's website:

<http://pages.stern.nyu.edu/~sternfin/pschnabl/>. All other values are from 2007 10K filings and authors' calculations.

Notes: AIG's real estate exposure includes investment of securities lending collateral in real estate related assets. CDS on residential mortgage and multi-sector CDOs are the notional value of AIG's credit default swap portfolio (by asset class). Equity is equal to total shareholders' equity as reported in the companies' 2007 10K filings on their consolidated balance sheets. Reported assets are equal to total assets as reported on the companies' consolidated balance sheets. Adjusted assets are equal to reported assets plus off-balance sheet ABCP and in AIG's case, their credit default swap portfolio. Please note that in addition to the CDS on residential mortgages and multi sector CDOs listed above, this also includes CDS on corporate loans (\$230 billion) and CDS on corporate debt/corporate CLOs (\$70 billion). Reported leverage is equal to reported assets divided by equity. Adjusted leverage is equal to adjusted assets divided by equity.

**Table 2: AIG financial indicators by operating segment, 2006-2009,  
\$ Billions**

Item	2006	2007	2008	2009
Revenues	113.39	110.06	11.10	96.00
Earnings	14.05	6.20	-99.29	-12.31
Realized capital gains	0.11	-3.59	-55.48	-6.86
Unrealized CDS losses (AIGFP)	0	-11.47	-28.60	1.42
<b>Operating Income:</b>				
General Insurance	10.41	10.53	-5.75	0.17
Life Insurance & Retirement Services	10.12	8.19	-37.45	2.04
Financial Services	0.38	-9.52	-40.82	0.52
Asset Management	1.54	1.16	-9.19	NA
<b>Assets</b>				
General Insurance	167.00	181.71	165.95	154.73
Life Insurance & Retirement Services	550.96	613.16	489.65	553.49
Financial Services	202.49	193.98	167.06	132.82
Asset Management	78.28	77.27	46.85	NA

Source: AIG 2008 10-K, p. 71, 194, 225 and AIG 2009 10-K, p. 72, 195, 230

Notes: In 2009, results from asset management activities were included in the Life Insurance & Retirement Services category. Revenue is composed of premiums and other income, net investment income, realized capital gains (or losses), and unrealized CDS losses. Earnings are equal to net income (or losses) as reported on AIG's consolidated statement of income. Realized capital gains are primarily comprised of sales of securities and other investments, foreign exchange transactions, changes in the fair value of non AIGFP derivative instruments that do not qualify for hedge accounting treatment, and other-than-temporary impairments on securities. Unrealized CDS losses are the unrealized market valuation loss on AIGFP's super senior credit default swap portfolio. Operating income is equal to pre-tax income (or loss) for each business segment. Assets are equal to year-end identifiable assets for each business segment.

**Table 3: AIG Credit Ratings, March 2005 – September 2008**

Date	Rating Firm	Rating
Pre 3/15/2005	All	AAA/Aaa
3/30/2005	S&P	AA+
6/03/2005	S&P	AA
5/08/2008	S&P	AA-
9/15/2008	S&P	A-
3/31/2005	Moodys	Aa1
5/02/2005	Moodys	Aa2
5/22/2008	Moodys	Aa3
9/15/2008	Moodys	A2
3/15/2005	Fitch	AA+
5/02/2005	Fitch	AA
5/08/2008	Fitch	AA-
9/15/2008	Fitch	A

Source: Bloomberg.

Notes: Prior to March 15, 2005 AIG was rated AAA by all three ratings agencies.

**Table 4: 2008 Statutory Capital: AIG Life Insurance Subsidiaries,  
with and without Q3 and Q4 Capital Infusions, Statutory \$ Million**

Company	State	2007 Assets \$	% of 2007 Assets in Securities Lending	2008	2008	2008	2008	2008
				Realized Securities Lending Losses \$	Regulatory "Adjusted" Capital \$	Capital Infusions Q3 & Q4 \$	Authorized Control Capital \$	Regulatory "Adjusted" Capital less Q3 & Q4 Capital Infusions
ALICO	DE	101,632	4.5%	470	4,332	967	NA	3,365
VALIC	TX	63,999	15.1%	3,563	2,940	3,621	486	-681
AIG Annuity	TX	50,553	39.7%	7,109	3,242	6,048	538	-2,806
Am. General Life	TX	33,682	31.3%	3,790	2,844	3,084	949	-240
SunAmerica Life	AZ	39,455	27.1%	2,281	4,805	1,366	692	3,439
AIG SunAmerica Life	AZ	35,072	6.1%	425	1,317	281	59	1,036
AIG Life	DE	10,790	23.6%	870	465	679	82	-214
Am. Gen Life & Accident	TN	9,134	33.9%	977	594	786	89	-192
First SunAmerica	NY	6,479	30.3%	654	550	947	63	-397
Am. International	NY	7,093	35.1%	771	458	801	74	-343
United States Life	NY	5,315	25.1%	395	305	456	50	-151
<b>Total: AIG Life</b>		<b>364,770</b>	<b>19.0%</b>	<b>21,305</b>	<b>22,488</b>	<b>20,003</b>	<b>4,972</b>	<b>2,485</b>

*Source:* Authors' calculations from insurance regulatory filings accessed through SNL Financial and March 5, 2009 Hearing before the Senate Committee on Banking, Housing and Urban Affairs <http://www.gpo.gov/fdsys/pkg/CHRG-111shrg51303/pdf/CHRG-111shrg51303.pdf> (page 43).

*Notes:* Table includes details for active securities lending participants with assets of at least \$5 billion. The "Total: AIG Life" row includes all AIG life insurance subsidiaries. If regulatory adjusted capital falls below the "authorized control" level, insurance regulators are authorized to take control of the company. If it falls below 70% of the authorized control level, they are mandated to take control of the company. See <http://www.naic.org/store/free/MDL-312.pdf>

**Table 5: Evolution of AIG collateral calls and collateral posted for AIG's CDS on Multi-Sector CDOs, Goldman Sachs, Societe Generale, and all counterparties combined**

\$ Millions

Counterparty	Date	Call	Posted
Goldman Sachs Intl	2008-06-30	7493	5913
Goldman Sachs Intl	2008-07-31	8254	6217
Goldman Sachs Intl	2008-08-31	8675	6818
Goldman Sachs Intl	2008-09-12	8979	7596
Goldman Sachs Intl	2008-09-15	10072	7596
Goldman Sachs Intl	2008-09-16	10065	7596
Societe Generale	2008-06-30	1937	1937
Societe Generale	2008-07-31	2271	1977
Societe Generale	2008-08-31	4271	3981
Societe Generale	2008-09-12	4280	4008
Societe Generale	2008-09-15	9833	4320
Societe Generale	2008-09-16	9818	5582
All Counterparties	2008-06-30	15780	13241
All Counterparties	2008-07-31	19321	14376
All Counterparties	2008-08-31	22241	17545
All Counterparties	2008-09-12	23441	18922
All Counterparties	2008-09-15	32013	19573
All Counterparties	2008-09-16	33879	22445

Source: AIG/Goldman Sachs Collateral Call Timeline, FCIC.

<http://fcic.law.stanford.edu/documents/view/2172>

**Table 6: Collateral Shortfall by Multi-Sector CDS Counterparty**

	<b>Total Assets</b>	<b>Total Shareholders Equity</b>	<b>Tier 1 Capital</b>	<b>AIG Shortfall</b>	<b>% Equity</b>	<b>% Tier 1 Capital</b>
Goldman Sachs	1,081.8	45.6	44.1	2.5	5.41%	5.60%
Societe Generale	1,694.4	56.0	40.7	4.2	7.56%	10.40%
Merrill Lynch	875.8	38.4	26.5	1.0	2.70%	3.90%
UBS	1,784.5	41.5	32.2	1.0	2.41%	3.11%
DZ Bank	677.0	10.6	14.3	0.7	7.00%	5.19%
Rabobank	894.0	45.0	47.0	0.6	1.31%	1.26%

Source: FCIC and author calculations using 2008 Q2 and Q3 financials. Goldman Sachs, Merrill Lynch, and UBS assets, shareholders equity, and tier 1 capital come from 2008Q3 financial statements. Societe Generale, DZ Bank, and Rabobank values come from 2008Q2 financial statements.

**Table 7: Summary statistics for Maiden Lane 2 portfolio**

	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
Notional (mm\$)	0.02	13.90	31.00	45.60	62.00	266.00
Purchase percentage	0.01	0.39	0.56	0.56	0.74	0.99
Sale percentage	0.00	0.37	0.58	0.57	0.81	1.02
Gain (mm\$)	-70.50	-0.29	1.53	3.98	7.19	76.40
Gain/cost	-0.95	-0.03	0.13	0.16	0.32	4.06
ABX return	-0.15	0.21	0.22	0.21	0.22	0.23
Return less ABX return	-1.18	-0.26	-0.07	-0.05	0.10	3.84

Source: Authors' calculations using data from the Federal Reserve Bank of New York and Markit.

Notes: "Purchase percentage" is the ratio of the price paid for each asset to its notional value. "Sale percentage" is the ratio of the price received for each asset to its notional value. All dollar values are in millions.

**Table 8: Summary statistics for Maiden Lane 3 portfolio**

	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
Notional (mm\$)	0.04	115.00	201.00	399.00	487.00	5400.00
Purchase percentage	0.10	0.34	0.48	0.46	0.55	0.94
Sale percentage	0.03	0.28	0.49	0.48	0.64	0.96
Gain (mm\$)	-172.00	5.47	36.80	63.50	78.20	779.00
Gain/cost	-0.85	0.21	0.35	0.36	0.55	1.24
Benchmark return	0.03	0.20	0.21	0.20	0.23	0.23
Return less Benchmark return	-0.91	0.01	0.14	0.15	0.34	1.02

Source: Authors' calculations using data from the Federal Reserve Bank of New York and Markit.

Notes: "Purchase percentage" is the ratio of the price paid for each asset to its notional value. "Sale percentage" is the ratio of the price received for each asset to its notional value. All dollar values are in millions. The "Benchmark return" is 30%xCMBX return + 70%xABX return.

**Table 9: Aggregate Performance of Maiden Lane Asset: origination through September 2014**

	<b>Date</b>			
	<b>At Origination</b>	<b>Beginning of Maiden Lane</b>	<b>Maiden Lane Sale</b>	<b>Most Recent</b>
ML2 Notional (\$ billions)	62.39	41.66	31.09	20.90
ML2 Amortization (\$ billions)	0.00	20.69	29.71	36.33
ML2 Write-down (\$ billions)	0.00	0.04	1.89	5.19
ML2 Incremental Write-down (%)	0.00	0.06	4.45	10.60
ML2 Write-down Since Start (%)	0.00	0.06	3.03	8.31
ML2 CUSIPs with Write-downs (%)	0.00	1.54	31.88	54.24
ML3 Notional (\$ billions)	77.54	63.56	41.53	27.44
ML3 Amortization (\$ billions)	0.00	13.49	34.60	46.77
ML3 Write-down (\$ billions)	0.00	0.01	0.39	1.00
ML3 Incremental Write-down (%)	0.00	0.02	0.60	1.46
ML3 Write-down Since Start (%)	0.00	0.02	0.51	1.29
ML3 CUSIPs with Write-downs (%)	0.00	2.61	5.88	12.42

Source: Authors' calculations using data from the Federal Reserve Bank of New York and Bloomberg.

Notes: Maiden Lane II securities include those for whom write-down data are available. Maiden Lane III figures omit two CDOs, Max\_07\_1 and Max\_08\_1, for which loss information is unavailable because the CDOs were unwound. "Origination" is the date the security was created, "Beginning of Maiden Lane" is approximately the time at which the asset was included in a Maiden Lane, "Maiden Lane Sale" is the approximate time at which the asset was sold by a Maiden Lane, and "Most Recent" refers to information from September 2014 or the most recent data available. Figures reflect total amounts for any security that was included in Maiden Lanes II and III and not the share of the issue those vehicles. For example, Maiden Lane might have owned 10% of a particular security and the figures in this table reflect totals for the security.

## Working Paper Series

A series of research studies on regional economic issues relating to the Seventh Federal Reserve District, and on financial and economic topics.

Corporate Average Fuel Economy Standards and the Market for New Vehicles <i>Thomas Klier and Joshua Linn</i>	WP-11-01
The Role of Securitization in Mortgage Renegotiation <i>Sumit Agarwal, Gene Amromin, Itzhak Ben-David, Souphala Chomsisengphet, and Douglas D. Evanoff</i>	WP-11-02
Market-Based Loss Mitigation Practices for Troubled Mortgages Following the Financial Crisis <i>Sumit Agarwal, Gene Amromin, Itzhak Ben-David, Souphala Chomsisengphet, and Douglas D. Evanoff</i>	WP-11-03
Federal Reserve Policies and Financial Market Conditions During the Crisis <i>Scott A. Brave and Hesna Genay</i>	WP-11-04
The Financial Labor Supply Accelerator <i>Jeffrey R. Campbell and Zvi Hercowitz</i>	WP-11-05
Survival and long-run dynamics with heterogeneous beliefs under recursive preferences <i>Jaroslav Borovička</i>	WP-11-06
A Leverage-based Model of Speculative Bubbles (Revised) <i>Gadi Barlevy</i>	WP-11-07
Estimation of Panel Data Regression Models with Two-Sided Censoring or Truncation <i>Sule Alan, Bo E. Honoré, Luojia Hu, and Søren Leth-Petersen</i>	WP-11-08
Fertility Transitions Along the Extensive and Intensive Margins <i>Daniel Aaronson, Fabian Lange, and Bhashkar Mazumder</i>	WP-11-09
Black-White Differences in Intergenerational Economic Mobility in the US <i>Bhashkar Mazumder</i>	WP-11-10
Can Standard Preferences Explain the Prices of Out-of-the-Money S&P 500 Put Options? <i>Luca Benzoni, Pierre Collin-Dufresne, and Robert S. Goldstein</i>	WP-11-11
Business Networks, Production Chains, and Productivity: A Theory of Input-Output Architecture <i>Ezra Oberfield</i>	WP-11-12
Equilibrium Bank Runs Revisited <i>Ed Nosal</i>	WP-11-13
Are Covered Bonds a Substitute for Mortgage-Backed Securities? <i>Santiago Carbó-Valverde, Richard J. Rosen, and Francisco Rodríguez-Fernández</i>	WP-11-14
The Cost of Banking Panics in an Age before “Too Big to Fail” <i>Benjamin Chabot</i>	WP-11-15

## Working Paper Series *(continued)*

Import Protection, Business Cycles, and Exchange Rates: Evidence from the Great Recession <i>Chad P. Bown and Meredith A. Crowley</i>	WP-11-16
Examining Macroeconomic Models through the Lens of Asset Pricing <i>Jaroslav Borovička and Lars Peter Hansen</i>	WP-12-01
The Chicago Fed DSGE Model <i>Scott A. Brave, Jeffrey R. Campbell, Jonas D.M. Fisher, and Alejandro Justiniano</i>	WP-12-02
Macroeconomic Effects of Federal Reserve Forward Guidance <i>Jeffrey R. Campbell, Charles L. Evans, Jonas D.M. Fisher, and Alejandro Justiniano</i>	WP-12-03
Modeling Credit Contagion via the Updating of Fragile Beliefs <i>Luca Benzoni, Pierre Collin-Dufresne, Robert S. Goldstein, and Jean Helwege</i>	WP-12-04
Signaling Effects of Monetary Policy <i>Leonardo Melosi</i>	WP-12-05
Empirical Research on Sovereign Debt and Default <i>Michael Tomz and Mark L. J. Wright</i>	WP-12-06
Credit Risk and Disaster Risk <i>François Gourio</i>	WP-12-07
From the Horse's Mouth: How do Investor Expectations of Risk and Return Vary with Economic Conditions? <i>Gene Amromin and Steven A. Sharpe</i>	WP-12-08
Using Vehicle Taxes To Reduce Carbon Dioxide Emissions Rates of New Passenger Vehicles: Evidence from France, Germany, and Sweden <i>Thomas Klier and Joshua Linn</i>	WP-12-09
Spending Responses to State Sales Tax Holidays <i>Sumit Agarwal and Leslie McGranahan</i>	WP-12-10
Micro Data and Macro Technology <i>Ezra Oberfield and Devesh Raval</i>	WP-12-11
The Effect of Disability Insurance Receipt on Labor Supply: A Dynamic Analysis <i>Eric French and Jae Song</i>	WP-12-12
Medicaid Insurance in Old Age <i>Mariacristina De Nardi, Eric French, and John Bailey Jones</i>	WP-12-13
Fetal Origins and Parental Responses <i>Douglas Almond and Bhashkar Mazumder</i>	WP-12-14

## **Working Paper Series** *(continued)*

Repos, Fire Sales, and Bankruptcy Policy <i>Gaetano Antinolfi, Francesca Carapella, Charles Kahn, Antoine Martin, David Mills, and Ed Nosal</i>	<b>WP-12-15</b>
Speculative Runs on Interest Rate Pegs The Frictionless Case <i>Marco Bassetto and Christopher Phelan</i>	<b>WP-12-16</b>
Institutions, the Cost of Capital, and Long-Run Economic Growth: Evidence from the 19th Century Capital Market <i>Ron Alquist and Ben Chabot</i>	<b>WP-12-17</b>
Emerging Economies, Trade Policy, and Macroeconomic Shocks <i>Chad P. Bown and Meredith A. Crowley</i>	<b>WP-12-18</b>
The Urban Density Premium across Establishments <i>R. Jason Faberman and Matthew Freedman</i>	<b>WP-13-01</b>
Why Do Borrowers Make Mortgage Refinancing Mistakes? <i>Sumit Agarwal, Richard J. Rosen, and Vincent Yao</i>	<b>WP-13-02</b>
Bank Panics, Government Guarantees, and the Long-Run Size of the Financial Sector: Evidence from Free-Banking America <i>Benjamin Chabot and Charles C. Moul</i>	<b>WP-13-03</b>
Fiscal Consequences of Paying Interest on Reserves <i>Marco Bassetto and Todd Messer</i>	<b>WP-13-04</b>
Properties of the Vacancy Statistic in the Discrete Circle Covering Problem <i>Gadi Barlevy and H. N. Nagaraja</i>	<b>WP-13-05</b>
Credit Crunches and Credit Allocation in a Model of Entrepreneurship <i>Marco Bassetto, Marco Cagetti, and Mariacristina De Nardi</i>	<b>WP-13-06</b>
Financial Incentives and Educational Investment: The Impact of Performance-Based Scholarships on Student Time Use <i>Lisa Barrow and Cecilia Elena Rouse</i>	<b>WP-13-07</b>
The Global Welfare Impact of China: Trade Integration and Technological Change <i>Julian di Giovanni, Andrei A. Levchenko, and Jing Zhang</i>	<b>WP-13-08</b>
Structural Change in an Open Economy <i>Timothy Uy, Kei-Mu Yi, and Jing Zhang</i>	<b>WP-13-09</b>
The Global Labor Market Impact of Emerging Giants: a Quantitative Assessment <i>Andrei A. Levchenko and Jing Zhang</i>	<b>WP-13-10</b>

## Working Paper Series *(continued)*

Size-Dependent Regulations, Firm Size Distribution, and Reallocation <i>François Gourio and Nicolas Roys</i>	WP-13-11
Modeling the Evolution of Expectations and Uncertainty in General Equilibrium <i>Francesco Bianchi and Leonardo Melosi</i>	WP-13-12
Rushing into American Dream? House Prices, Timing of Homeownership, and Adjustment of Consumer Credit <i>Sumit Agarwal, LuoJia Hu, and Xing Huang</i>	WP-13-13
The Earned Income Tax Credit and Food Consumption Patterns <i>Leslie McGranahan and Diane W. Schanzenbach</i>	WP-13-14
Agglomeration in the European automobile supplier industry <i>Thomas Klier and Dan McMillen</i>	WP-13-15
Human Capital and Long-Run Labor Income Risk <i>Luca Benzoni and Olena Chyruk</i>	WP-13-16
The Effects of the Saving and Banking Glut on the U.S. Economy <i>Alejandro Justiniano, Giorgio E. Primiceri, and Andrea Tambalotti</i>	WP-13-17
A Portfolio-Balance Approach to the Nominal Term Structure <i>Thomas B. King</i>	WP-13-18
Gross Migration, Housing and Urban Population Dynamics <i>Morris A. Davis, Jonas D.M. Fisher, and Marcelo Veracierto</i>	WP-13-19
Very Simple Markov-Perfect Industry Dynamics <i>Jaap H. Abbring, Jeffrey R. Campbell, Jan Tilly, and Nan Yang</i>	WP-13-20
Bubbles and Leverage: A Simple and Unified Approach <i>Robert Barsky and Theodore Bogusz</i>	WP-13-21
The scarcity value of Treasury collateral: Repo market effects of security-specific supply and demand factors <i>Stefania D'Amico, Roger Fan, and Yuriy Kitsul</i>	WP-13-22
Gambling for Dollars: Strategic Hedge Fund Manager Investment <i>Dan Bernhardt and Ed Nosal</i>	WP-13-23
Cash-in-the-Market Pricing in a Model with Money and Over-the-Counter Financial Markets <i>Fabrizio Mattesini and Ed Nosal</i>	WP-13-24
An Interview with Neil Wallace <i>David Altig and Ed Nosal</i>	WP-13-25

## **Working Paper Series** *(continued)*

Firm Dynamics and the Minimum Wage: A Putty-Clay Approach <i>Daniel Aaronson, Eric French, and Isaac Sorkin</i>	<b>WP-13-26</b>
Policy Intervention in Debt Renegotiation: Evidence from the Home Affordable Modification Program <i>Sumit Agarwal, Gene Amromin, Itzhak Ben-David, Souphala Chomsisengphet, Tomasz Piskorski, and Amit Seru</i>	<b>WP-13-27</b>
The Effects of the Massachusetts Health Reform on Financial Distress <i>Bhashkar Mazumder and Sarah Miller</i>	<b>WP-14-01</b>
Can Intangible Capital Explain Cyclical Movements in the Labor Wedge? <i>François Gourio and Leena Rudanko</i>	<b>WP-14-02</b>
Early Public Banks <i>William Roberds and François R. Velde</i>	<b>WP-14-03</b>
Mandatory Disclosure and Financial Contagion <i>Fernando Alvarez and Gadi Barlevy</i>	<b>WP-14-04</b>
The Stock of External Sovereign Debt: Can We Take the Data at 'Face Value'? <i>Daniel A. Dias, Christine Richmond, and Mark L. J. Wright</i>	<b>WP-14-05</b>
Interpreting the <i>Pari Passu</i> Clause in Sovereign Bond Contracts: It's All Hebrew (and Aramaic) to Me <i>Mark L. J. Wright</i>	<b>WP-14-06</b>
AIG in Hindsight <i>Robert McDonald and Anna Paulson</i>	<b>WP-14-07</b>